

Aalborg Universitet



**AALBORG UNIVERSITY**  
DENMARK

## **Webinar: Blockchain in the energy industry**

*EnergyTech Blockchain Jam*

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# EnergyTech Blockchain Jam

**:agile**  
accelerator  
powered by **e-on**



**bne**  
Bundesverband  
Neue Energiewirtschaft



# Blockchain

## Will it revolutionise the energy market?

Kirsten Hasberg ■ Ph.D. fellow, Aalborg University CPH ■ BlockchainHub Berlin BlockchainHub Berlin  
@energydemocracy

Oliver Beige ■ Chief Economist, ABC - Agnostic Blockchain Consultants  
Ph.D. UC Berkeley ■ prvsly SAP & Daimler ■ @ecoinomia



# The Market for Energy: Is it Ready for Disruption?





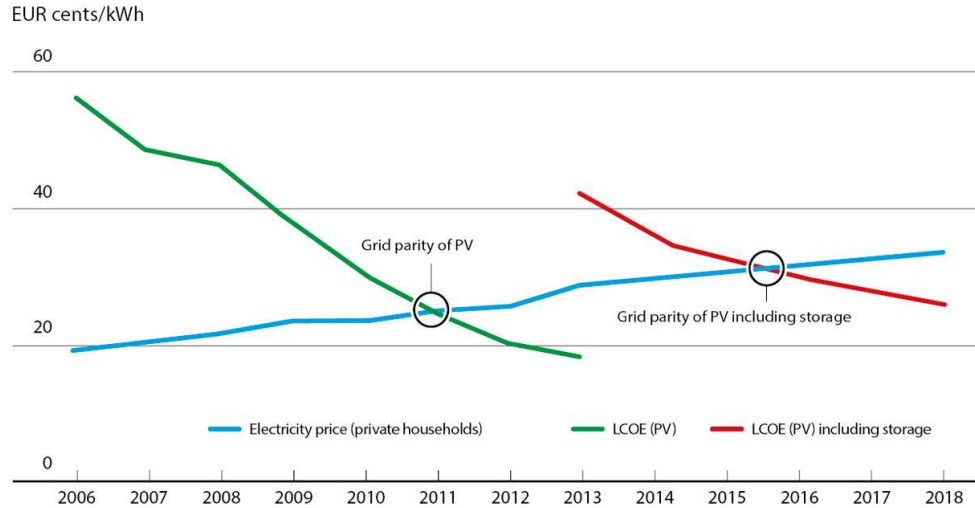
Energy production is increasingly decentralized and community based...



...but grid balancing, trading and billing is still centralised, ...



FIGURE 5.17: GRID PARITY OF PV-STORAGE IN GERMANY



Source: EuPD Research/ BDEW 2013.



... although grid parity is here, ...

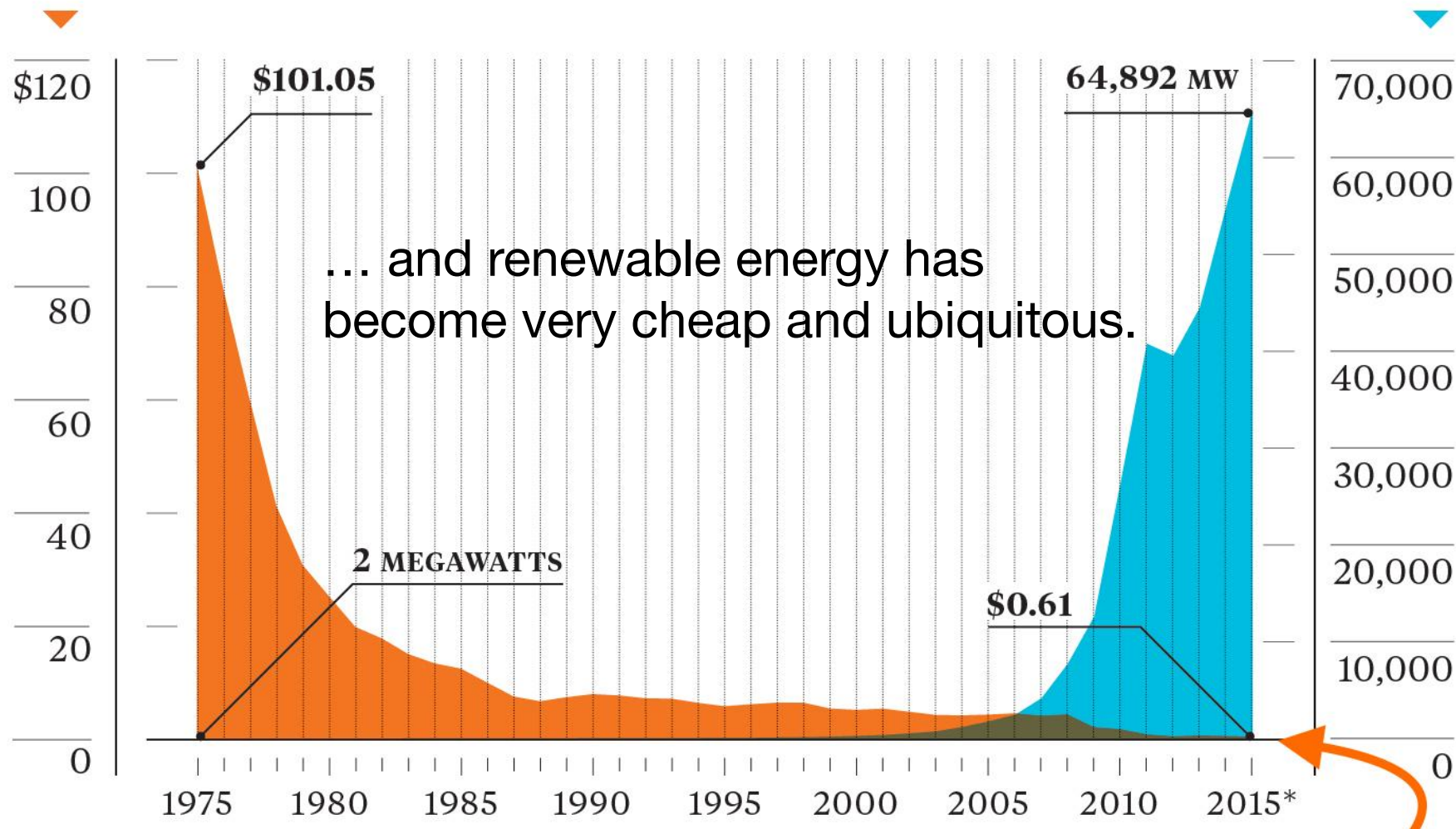
June 2017, Germany:

1 kWh solar PV (on field) costs 5,66 EUR cent

1 kWh mixed electricity from household retailer costs 29 EUR cent

## Price of a solar panel per watt

## Global solar panel installations







People won't accept being excluded from buying to cheap, renewable and local electricity for long.

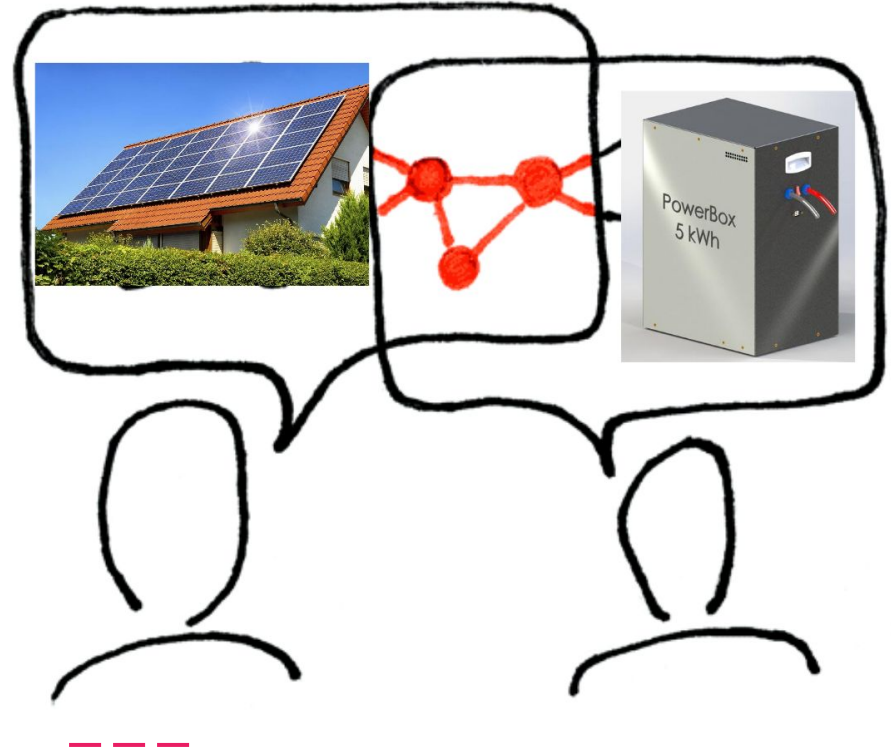


# This “Blockchain” thing

... could allow prosumers to trade electricity locally, without a central intermediary.

Finally, everybody can take part in the rapidly declining costs of electricity.

## But how?





**How can the blockchain help  
democratizing the energy market?**

A hand holding a pen and a magnifying glass over a document, with a red overlay.

Let's start with the basics:  
transactions and ledgers.

# Transactions

are the atoms of  
global commerce.

And have been  
for hundreds of years.

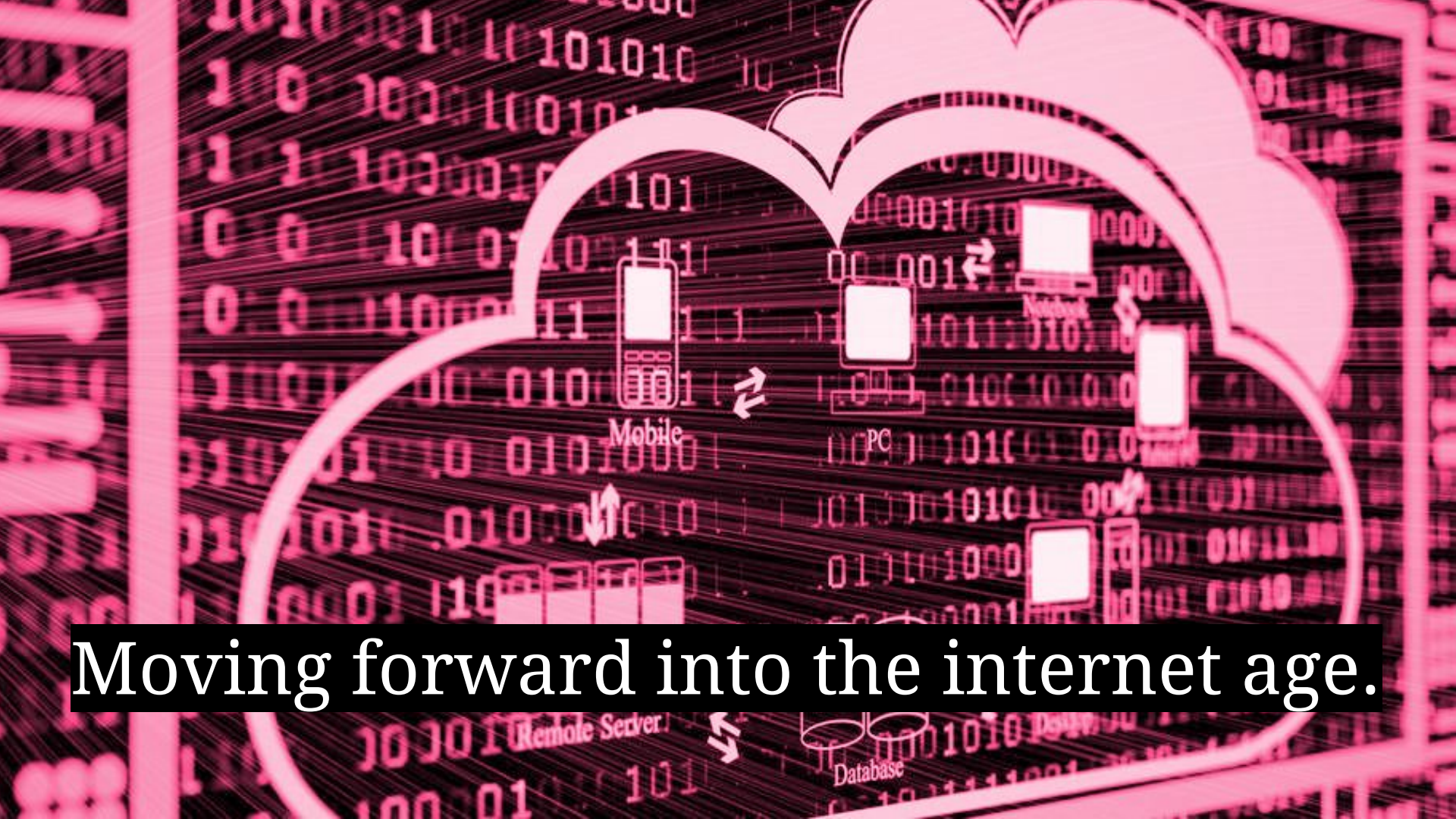
12 Oct 1651. Received 4 *fl.*  
from Florian for flowers.

16 Oct 1651. Paid 6 *fl.*  
to Fiorentina for flour.

18 Oct 1651. Paid 12 *fl.*  
to Fernando for flounders.

19 Oct 1651. Received 3 *fl.*  
from Franziska for fowl.





Moving forward into the internet age.



Transactions  
are still being recorded  
in ledgers: enterprise  
“systems of record”

Some of them are even  
in the cloud.

But each company still  
records its own version  
of the transactions.

12 Oct 1651. Received 4 *fl.*  
from Florian for flowers.  
16 Oct 1651. Paid 6 *fl.*  
to Fiorentina for flour.  
18 Oct 1651. Paid 12 *fl.*  
to Fernando for flounders.  
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Remote Server

Database



Florian's ledger:  
"Paid 6 *fl.*  
to Fiorentina."

Fiorentina's ledger:  
"Received 4 *fl.*  
from Florian."

But what if there's a conflict?





Paid 6 *fl.*  
to Fiorentina.

Received 4 *fl.*  
from Florian.

**Florian paid 5 *fl.*  
to Fiorentina.**

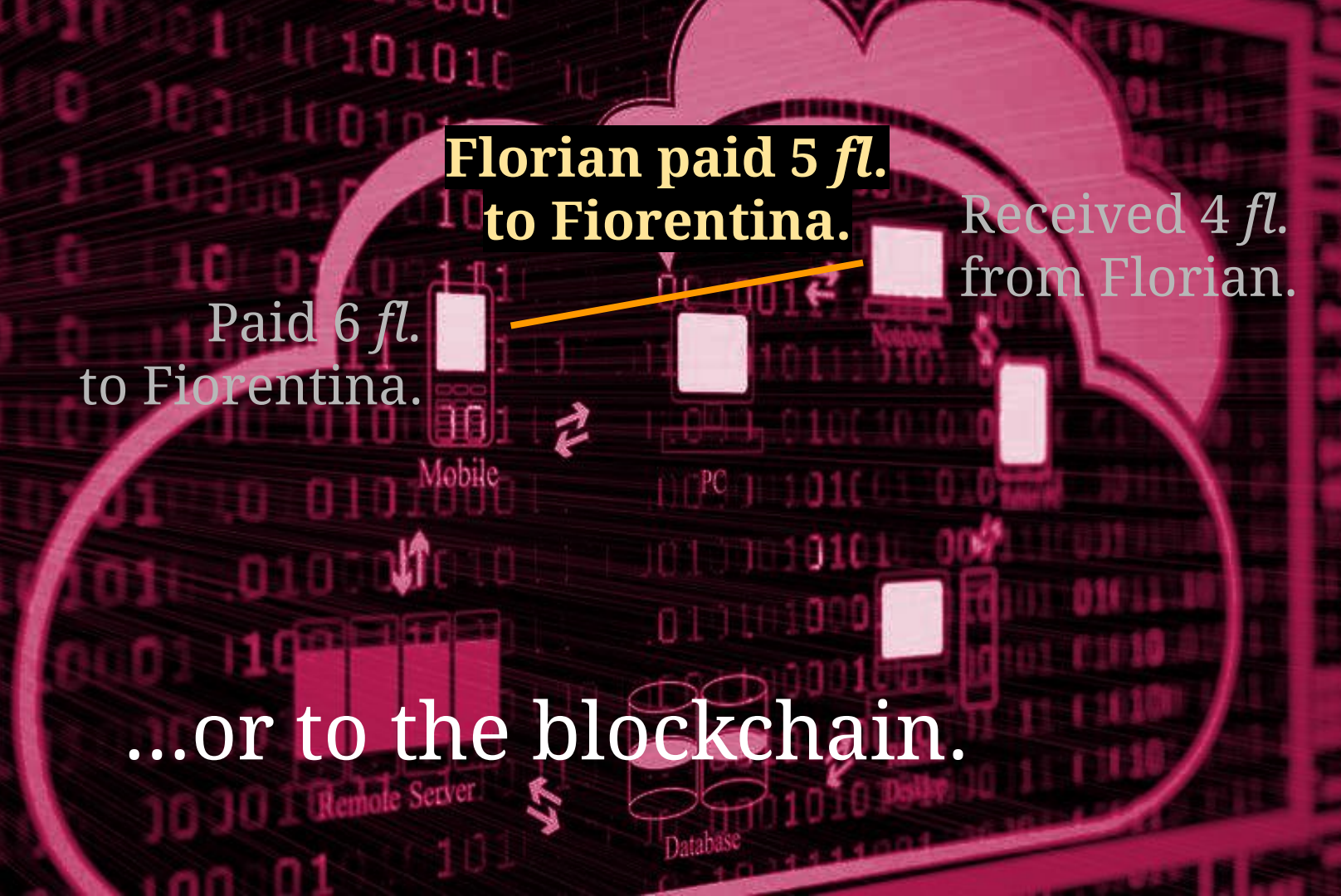
You can leave the resolution to a bank  
(the famous “trusted intermediary” or “middleman”)

**Florian paid 5 fl.  
to Fiorentina.**

Received 4 fl.  
from Florian.

Paid 6 fl.  
to Fiorentina.

...or to the blockchain.

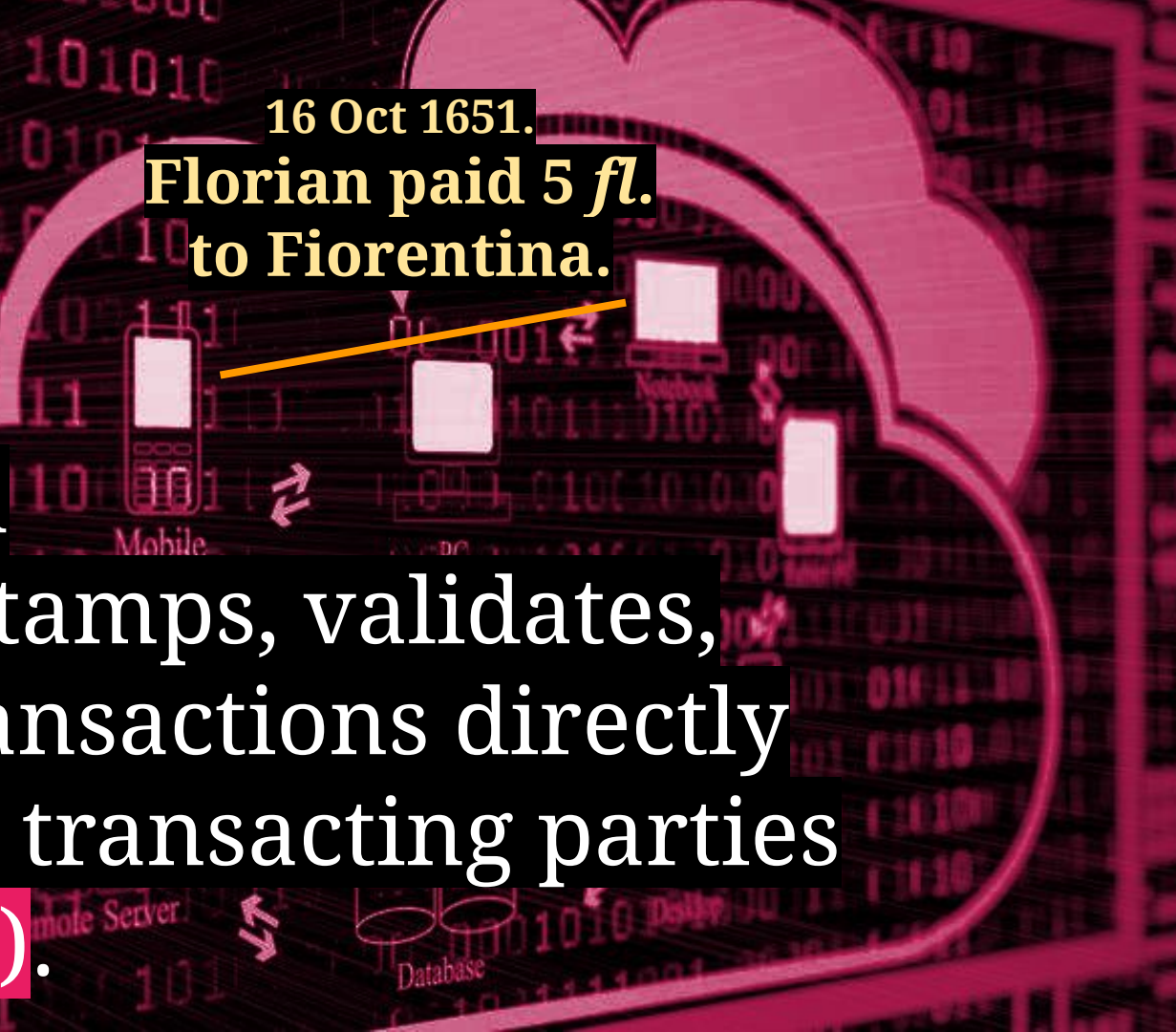




16 Oct 1651.

**Florian paid 5 *fl.*  
to Fiorentina.**

The blockchain  
records, time-stamps, validates,  
and persists transactions directly  
in-between the transacting parties  
("peer-to-peer").

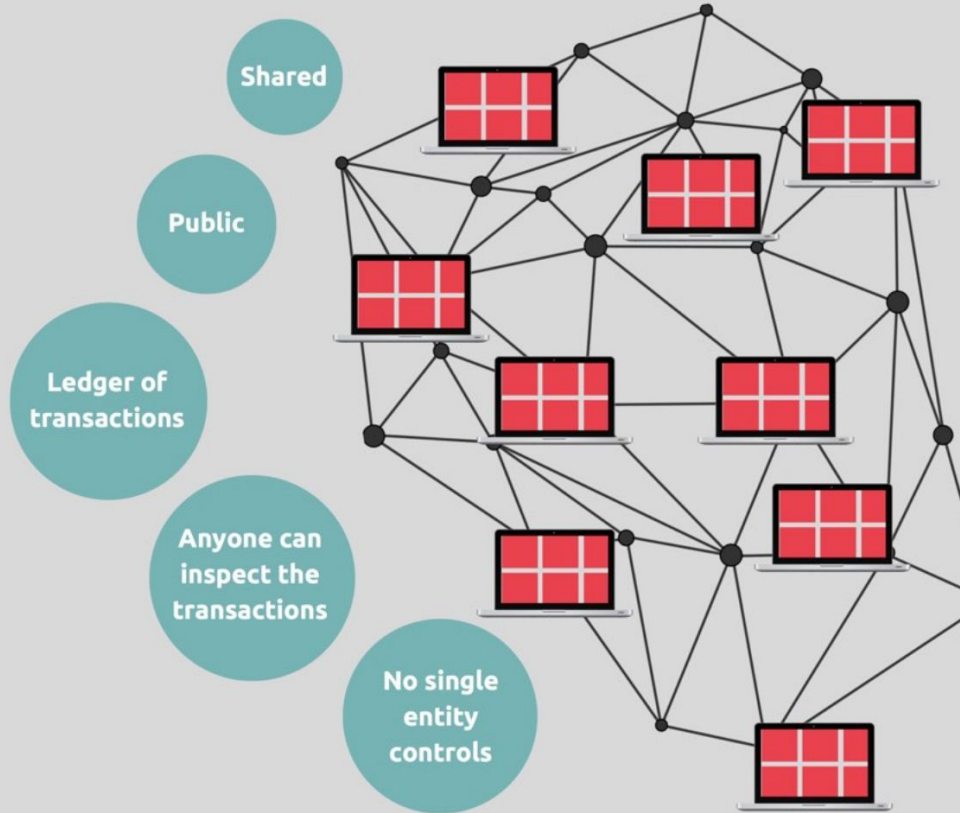




# What is a blockchain?

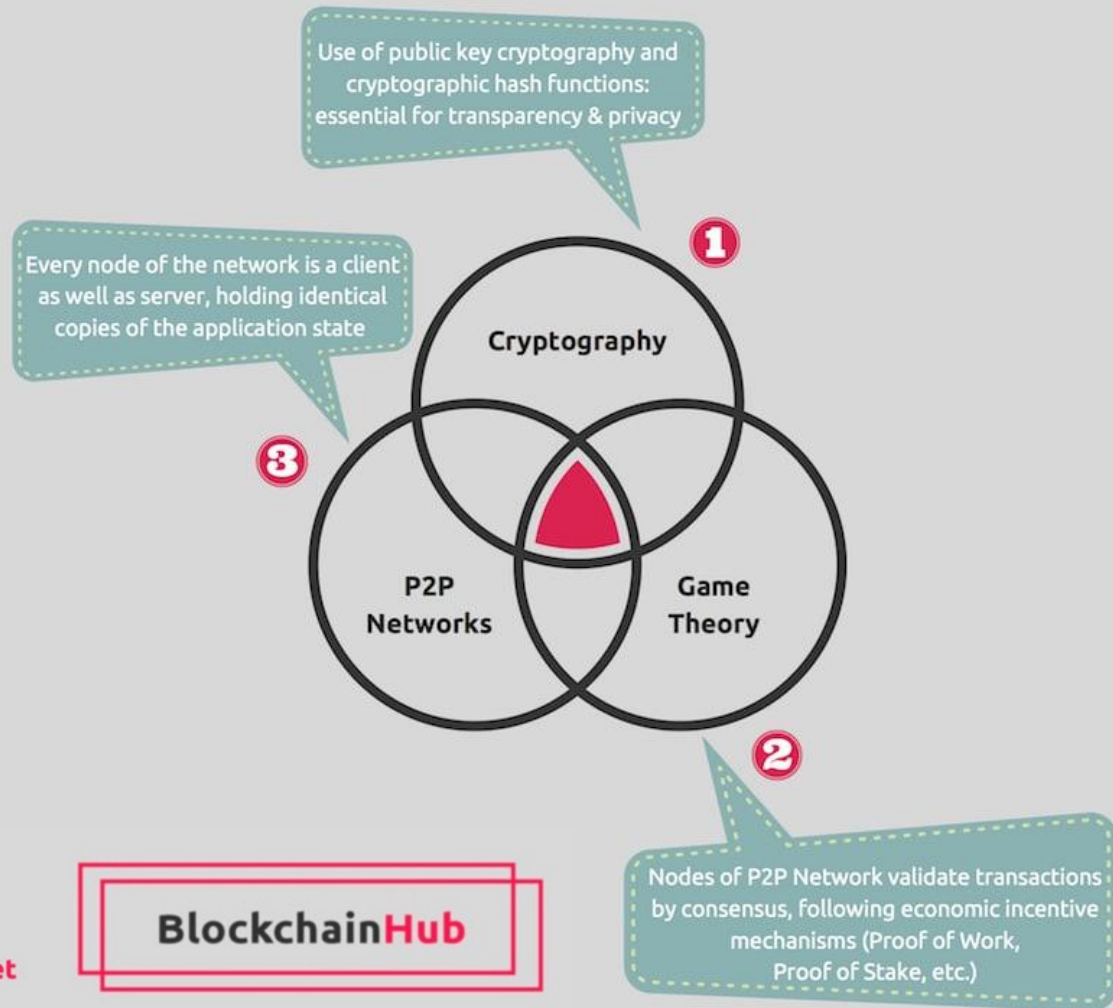
**BlockchainHub**

Like a Spreadsheet in the Sky




All network transactions get stored in the blockchain

# Combination of three technologies

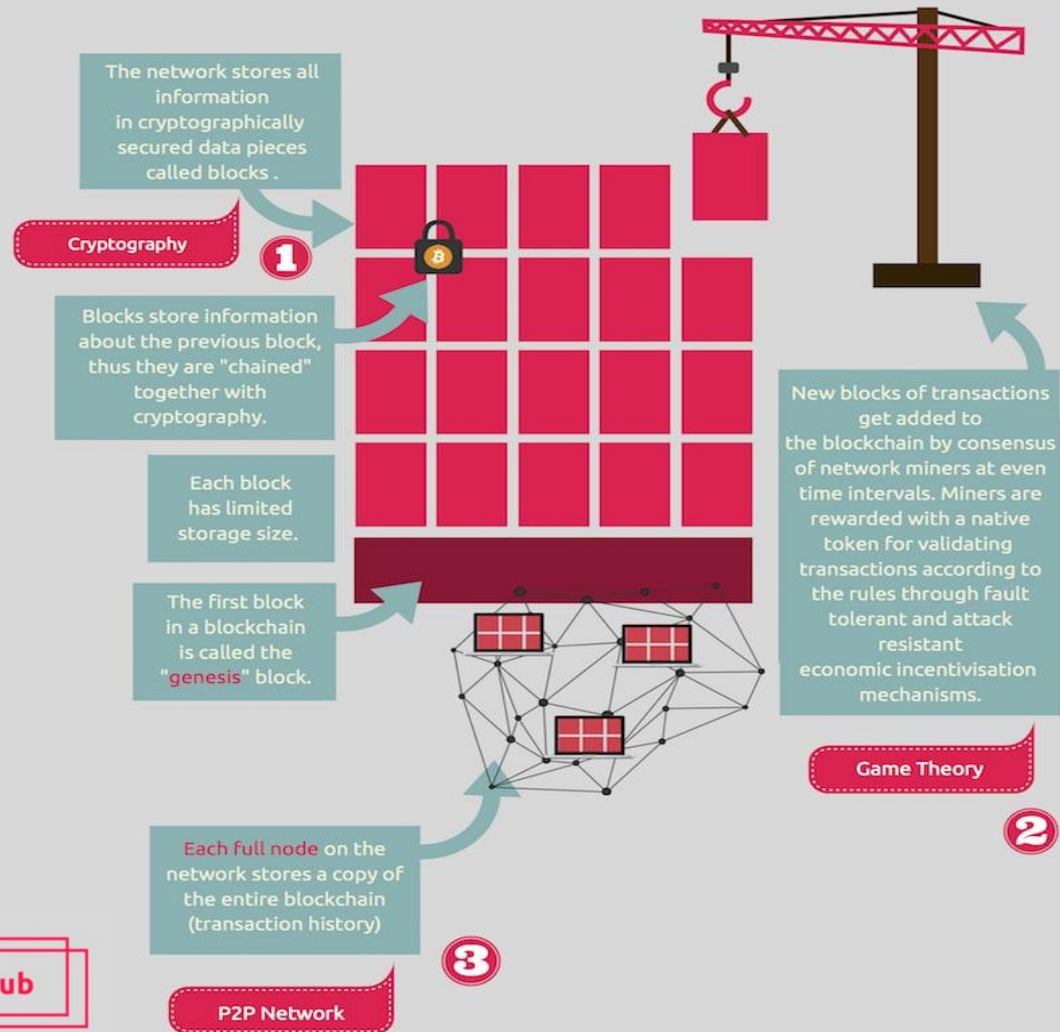


**Authors:** Shermin Voshmgir, Valentin Kalinov

**Creative Commons Licence:** Attribution, Share Alike 

**Owned and originally published by:** <https://blockchainhub.net>

# Why is it called a blockchain?



## Why is Blockchain Tamper Resistant?



Each network participant keeps a copy of the entire blockchain - the file where all past transactions are recorded. Consensus of network validators verifies new transactions. In the Bitcoin network transactions are validated by network miners who are incentivised to verify transactions through PoW (Proof of Work).



If a malicious party makes unauthorized changes to his copy of the blockchain on one computer, other members of the network will refuse the transaction since that malicious version of the blockchain data will differ from the rest of the network.

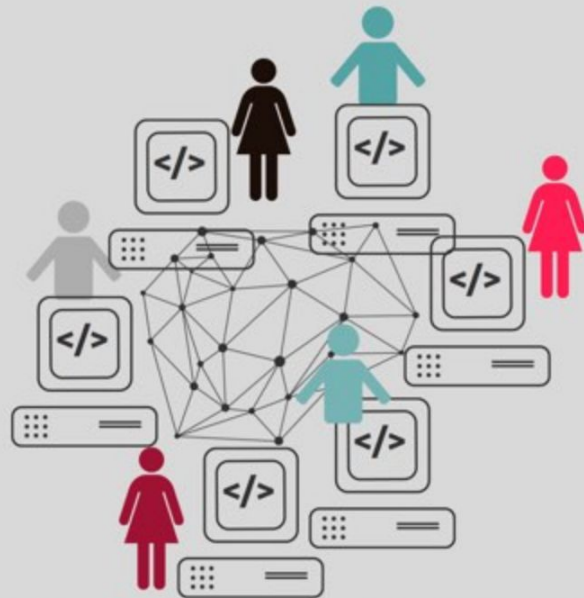


To manipulate data on the blockchain, one will have to manipulate data on the majority of the network. This is possible, but prohibitively expensive, especially if you need to manipulate old data and go back many blocks!

# Data Monarchy <> Data Democracy



**Server:**  
Unique Point of Failure!



**P2P Network:** If parts of the network fail, the rest of the network will still be functional and safe



# Types of blockchains

Equivalent to Internet  
in 1990ies?

## Public Blockchains

Bitcoin  
Ethereum  
Litecoin  
etc...

Equivalent to Intranet  
in 1990ies?

## Federated Blockchains

R3, B3i  
EWF

## Private Blockchains

Company  
internal

Distributed  
Ledger  
Technologies?




Internet of  
Blockchains?

# Smart Contracts

*“The handshake  
seals the contract.  
From the contract  
there’s no turning back.”*

Depeche Mode: “Everything Counts” (1986)



“Let’s commit now that  
if this event happens  
this transaction will be  
triggered automatically.”

.....

.....

Signed.


Signed.



```
60     var s = document.getElementsByTagName("script")[0];
61     s.parentNode.insertBefore(ga, s);
62 }
63 </script>
64 <?php
65     if (is_singular() && get_option('thread_comments')) {
66         wp_enqueue_script('comment-reply');
67     }
68     ?>
69     <?php wp_head(); ?>
70 </head>
71 <body <?php body_class(); ?>>
72     <div id="header">
73         <div class="wrapper">
74             <h1>
75                 <?php if (is_front_page() && Spaced < 2): ?>
76                     
77                 <?php else : ?>
78                     Root
79             </h1>
80             <form id="search" method="get">
81                 <div>
```

Enter Ethereum.

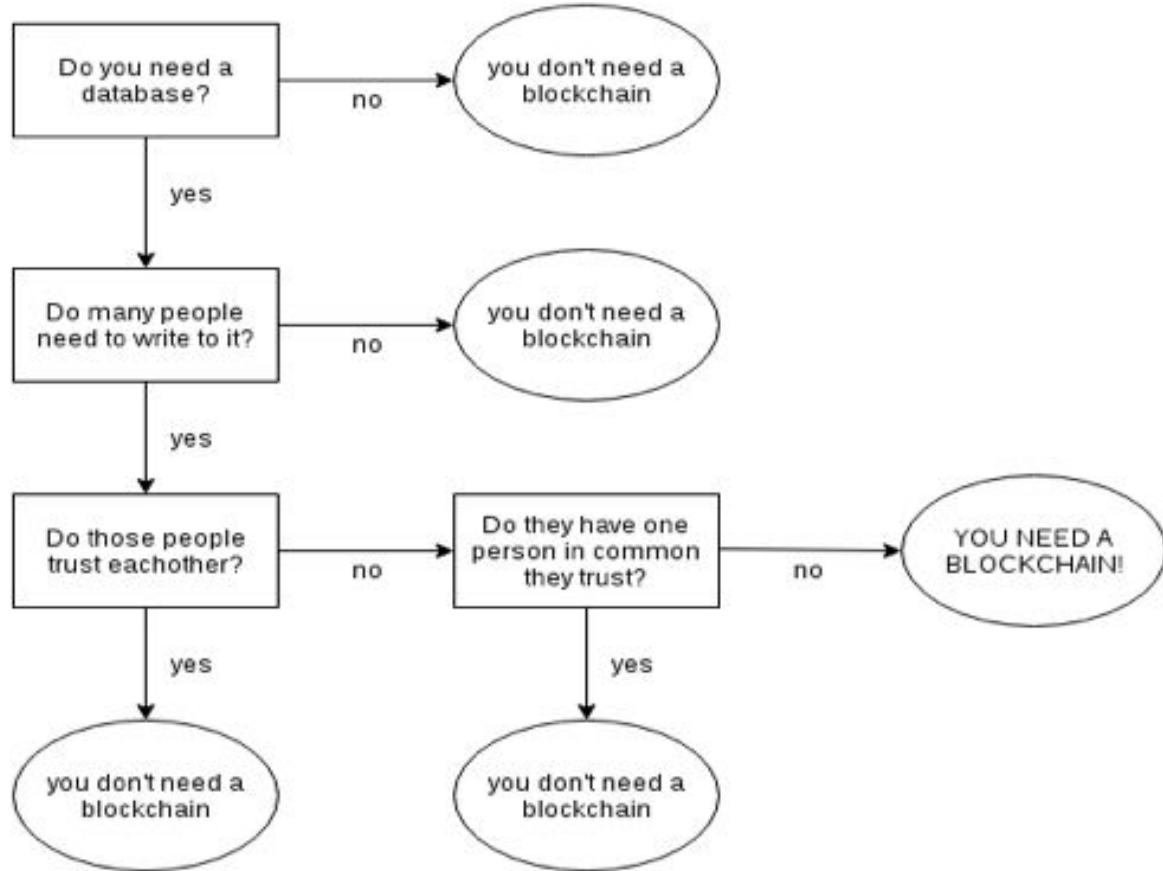




The background of the image is a blurred screenshot of a code editor. On the left side, there is a vertical list of line numbers from 60 to 81. The code itself is a mix of JavaScript and PHP. Visible JavaScript includes `var s = document.get...`, `s.parentNode.insertBefore(ga, s);`, and a closing script tag `</script>`. Visible PHP includes `<?php wp_head();`, `</head>`, `<body <?php body_...`, `<div id="header">`, `<div class="inner">`, `<h1>`, `<?php if (is_front_page() &`, `<?php else :`, `<?php endif>`, `<?php method="get"`, and `<div>`. The text "Ethereum" is highlighted in a pink box.

**Ethereum** uses a scripting language called Solidity to allow simple drafting of smart contracts which are executed (for a fee) on the Ethereum blockchain.

Finally the key question: (When) do you **really** need a blockchain?





**Hypothesis:**

**Peer-to-peer transactions without a middleman  
= Democratization of energy trading?**



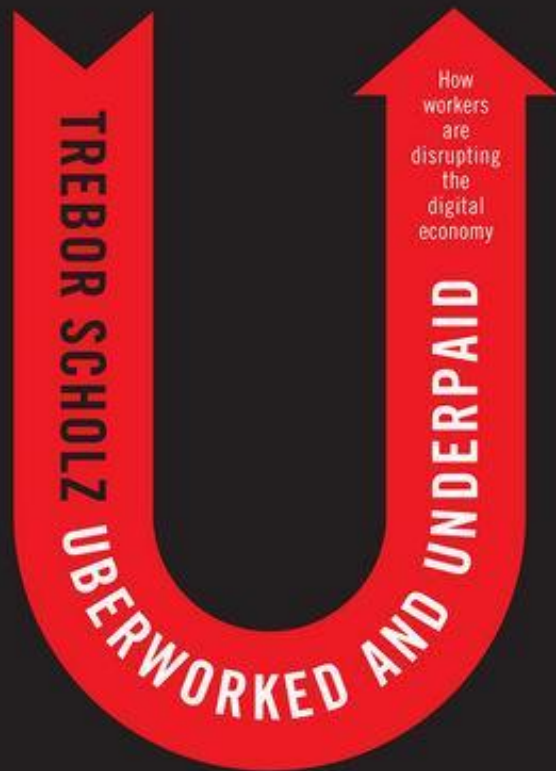
# The Platform quote that became an Internet Meme:

Source: Tom Goodwin,  
Havas Media, 3.3.2015,  
“The Battle Is For The  
Customer Interface”

*”Uber, the world’s largest taxi company, owns no vehicles. Facebook, the world’s most popular media owner, creates no content. Alibaba, the most valuable retailer, has no inventory. And Airbnb, the world’s largest accommodation provider, owns no real estate. Something interesting is happening.”*

— — —

**Disrupting the Disruptors:**  
**Peer-to-Peer Transactions**  
without a middleman on the blockchain



*"Every Uber  
has an Under"*  
Trebor Scholz



# From aggregation economy...

Tapscott & Tapscott:  
Blockchain Revolution  
(2016)

*"Today's sharing economy  
is "a nice notion (...).  
But these businesses have  
little to do with sharing.  
In fact, they are  
successful precisely  
because they do not share  
– they aggregate."*

— — —

# NETWORKED MONOPOLIES

THE PROCESS OF CROWDSOURCING MONOPOLY POWER



BUDDING NETWORK EFFECT

GROWING NETWORK UTILITY

FULL-FLEDGED NETWORKED MONOPOLY

# ... to a real sharing economy

Tapscott & Tapscott:  
Blockchain Revolution  
(2016)

*"Imagine instead of the  
centralized company  
Airbnb, a distributed  
application – call it  
blokchain Airbnb or  
bAirbnb – essentially a  
cooperative owned by its  
members."*

— — —



# BUSINESS LANDSCAPE

A COMPARISON OF EXISTING AND EMERGENT BUSINESS MODELS



## TRADITIONAL

Business model is based on resource extraction.

Value is created by products or services. Consumers and workers have minimal power over technology.

## PLATFORM

Not based on extraction. Value is created by users sharing content in an online network, giving them power over technology to communicate.

## SHARING PLATFORM

Consciously not based on resource extraction, but rather on facilitating the exchange of resource. Value is created by users - consumers and workers - sharing access to underused assets or human resource as part of an online network. An intermediary connects users and oversees activity on a platform, but users have some power over technology to change how they live and work.

## CO-OPERATIVE SHARING PLATFORM

Similar to a sharing platform, but the online network is co-operative. No intermediary is needed, in some cases because of blockchain technology. Users, but particularly workers, have power over technology to change how they live and work.

# Blockchain as Commons 3.0

Source: Potts, De Filippi  
& Davidson: The Economics  
of Blockchain (2016)

*"Blockchain is Commons 3.0  
in that it provides a  
technical solution  
(cryptographic consensus)  
to the problem of  
cooperation in joint or  
group production at scale  
(...)"*

— — —



?

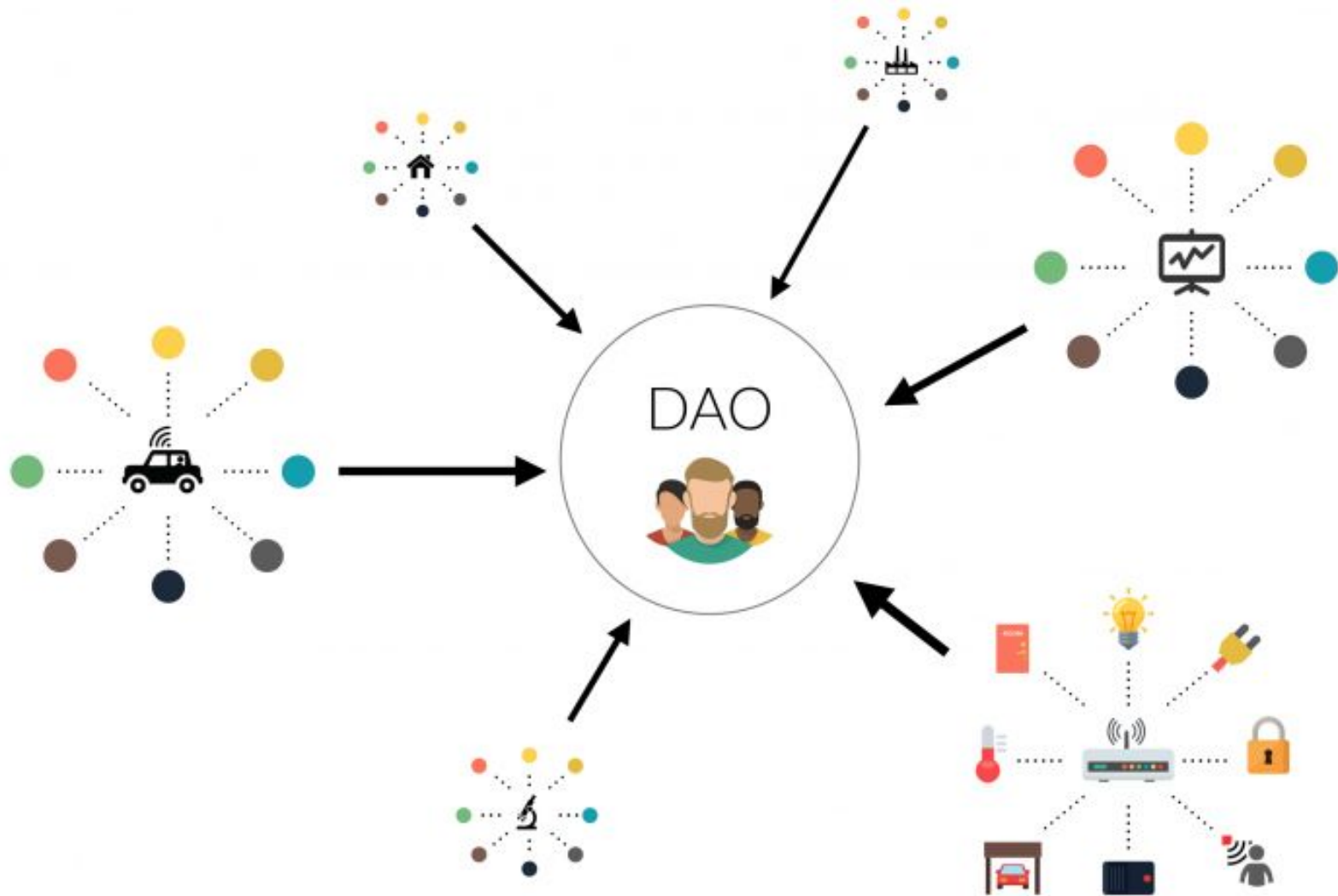


# Money without Banks



# Companies without Managers





# Nations without Politicians

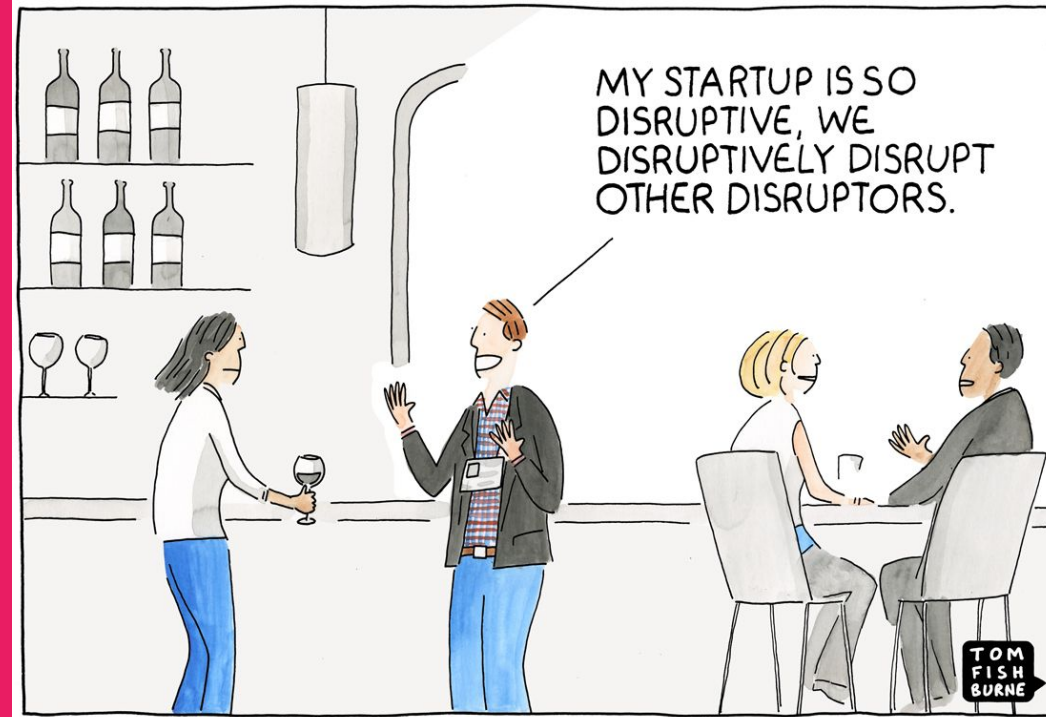


BITNATION

GOVERNANCE 2.0



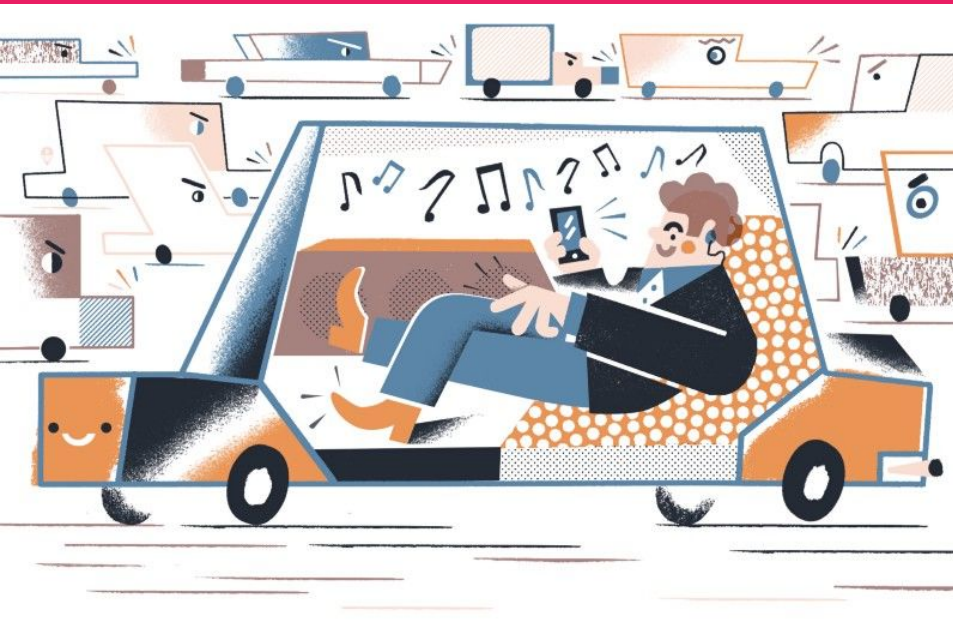
# But also: Disruption of the Disruptors



# “Spotify” ohne Spotify: Ujo Music



# “Uber” without Uber: La’Zooz





# “Amazon” without Amazon: OpenBazaar



*"Our goal with OpenBazaar 2.0 is to get it to be, with the exception of using bitcoin, ... an identical experience of what you'd see on Etsy. I think the 2.0 [version] is close to that."*

CEO Brian Hoffman, February 2017

— — —

# Blockchain: Energieversorgung ohne EVU

**INFORMATIONSTECHNOLOGIE** In New York tauschen zehn Haushalte untereinander Photovoltaik-Überschussstrom aus. Versorger  
liker bekommen davon nichts mit. Blockchain macht's möglich. Die Transaktionskosten interner Prozesse sinken um 95 Prozent

Politik Wirtschaft Panorama Sport München Bayern Kultur Wissen Digital Chancen Reise Auto Stil mehr... Q

14. August 2016, 18:11 Uhr Energie

## Wie Blockchain-Technik das Energiesystem revolutionieren kann

# Energy without utilities



WIRTSCHAFT \_Blockchain

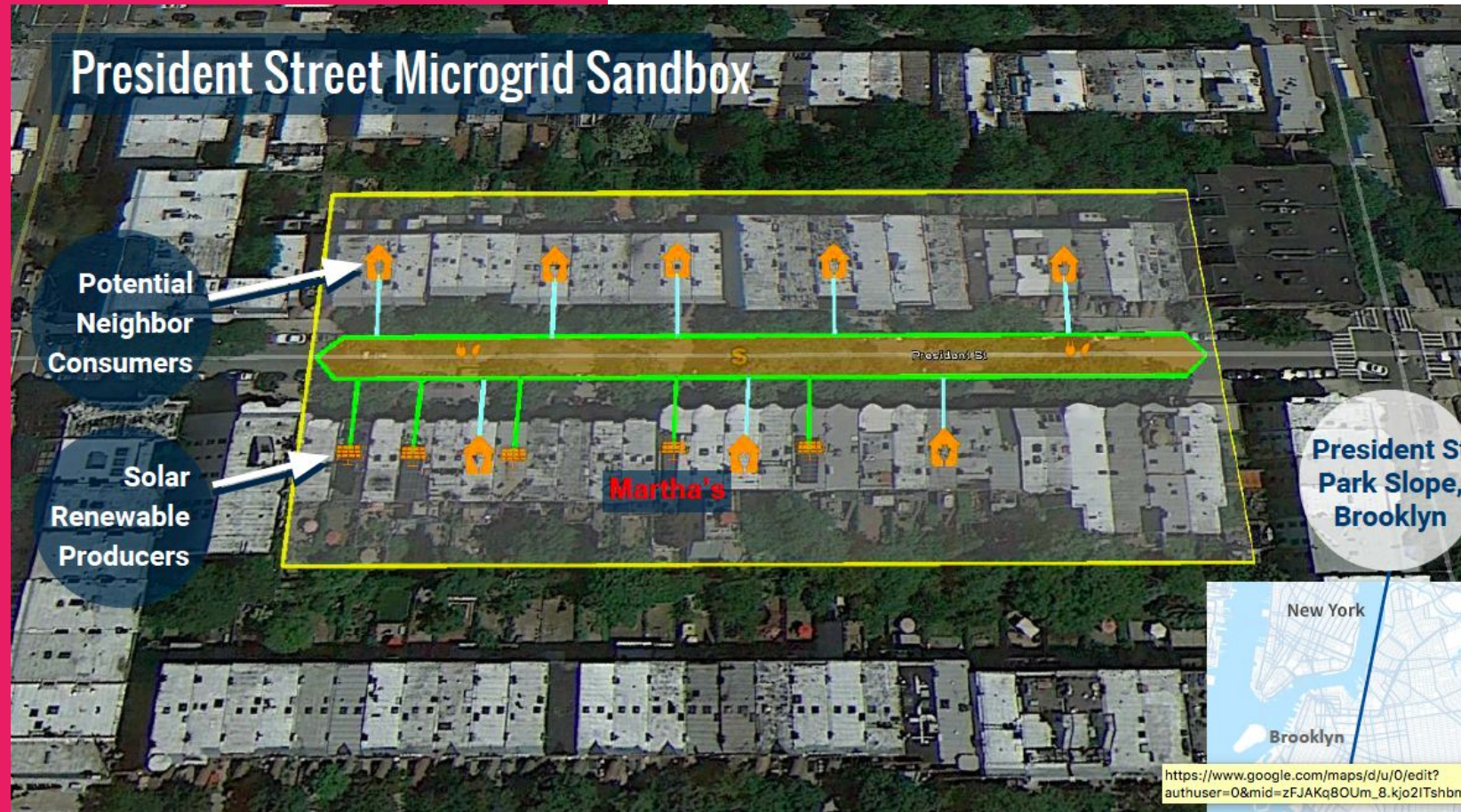


## „Ein neues Geschäftsmodell für Anlagenbetreiber“

**Programm**

**Blockchain-Tag für die Energiewelt 2016**  
**23. Mai 2016 in Berlin**

# USA: TransactiveGrid





# US: GridX



[Home](#) [Token Sale](#) [White Paper](#) [FAQ](#) [Blog](#)

GRID Token Sale Starts: Oct 30th 12pm EST

31 18 17 56  
days hrs mins secs

[Learn More About GRID Token Sale →](#)

## Welcome To The Future Of Energy

Grid+ leverages the Ethereum blockchain to give consumers direct access to wholesale energy markets. This decreases costs, shifts production closer to demand, and moves us all toward a cleaner energy future.



# Australia:



[Asset Germination Events](#) [Contact](#)

## Blockchain Energy Trading Startup Power Ledger Raises \$17M in Cryptocurrency 'ICO'

Posted on *September 13, 2017*

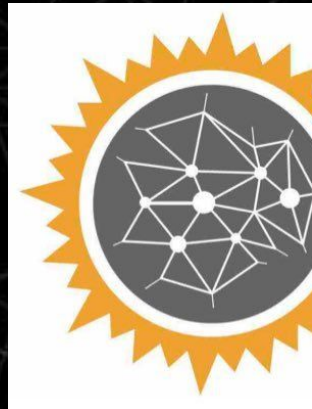
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Vienna / Berlin:

# GridSingularity / Energy Web Foundation



GSy





# Denmark: The Energy Collective

DTU – Technical University of  
Denmark

## Professor: Deleøkonomi på vej i elforsyningen



Privat ejerskab af solceller og batterier åbner muligheden for at decentralisere og demokratisere elforsyningen på en helt ny og 'disruptiv' måde, mener DTU-prof.

# GERMANY: **StromDAO**



# Germany: Gridx, Conjoule & Sonnen/Tennet



Home Unsere Kernaufgaben ▾ Unser Netz ▾ Strommarkt ▾ Unternehmen ▾



News 02.05.2017

Haushalte stabilisieren das Stromnetz:  
TenneT und sonnen vernetzen erstmals  
Stromspeicher mit Blockchain-Technologie

+ Downloads & Kontakt

## Dein digitaler Stromvertrag

Die Plattform, die alle Stromverbraucher und Stromproduzenten zusammenbringt.



Home How it works Contact Login

Did you ever think about it?  
Conjoule  
producers

## THE ENERCHAIN PROJECT



"Enerchain" is PONTON's activity  
focussing on blockchain technology in  
the energy sector

PONTON sees several application areas for using blockchain



# DANKE!

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UC Berkeley

ABC. Agnostic Blockchain Consultants

Factory Berlin

@ecoinomia

Kirsten Hasberg

Aalborg University CPH

BlockchainHub Berlin

@energydemocracy

— — —